

## Acute apical periodontitis: incidence of post-operative pain using two different root canal dressings

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### Summary

**A clinical study using non-vital maxillary central incisors exhibiting acute apical periodontitis was carried out to evaluate the incidence of post-operative pain after biomechanical preparation and dressing with a calcium-hydroxide paste or a corticosteroid-antibiotic solution. Sixty teeth from 48 patients were prepared and dressed on the first visit and re-evaluated clinically 7 days later. No difference was observed in the incidence of post-operative pain between the two groups.**

**Keywords:** calcium hydroxide, corticosteroid-antibiotic solution, inter-appointment pain, root canal dressing.

### Introduction

Acute apical periodontitis describes acute inflammation of the apical periodontium which originates mainly from a non-vital pulp. Necrotic tissue and/or derived by-products may evoke inflammation of the periradicular tissues via the root canal system or by traumatic injuries to the crown of the tooth. The characteristics of this pathology are much more microscopic and symptomatic than radiographic (Leal & Lauand 1991, De Deus 1992).

Histologically, acute apical periodontitis exhibits a typical inflammatory reaction with hyperaemia, increased vascular permeability, exudate and the presence of polymorphonuclear neutrophils. The interstitial fluid rapidly fills the space between bone and tooth and, because it is not compressible, a minimum external force applied on the affected tooth, pushes the fluid against nerve fibres resulting in pain. Immunological reactions are also present and have been described by many authors (Maisto 1975, Blanco & Ritacco 1987, Cohen 1991, Leal & Lauand 1991, Simon 1991, Torabinejad & Walton 1994).

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Clinically, pain is the common finding: its characteristics are described as constant, gnawing, throbbing or pounding. Sometimes it may be excruciating and last for days (Marshall 1979, Ingle *et al.* 1985). A painful response occurs when the affected tooth contacts its antagonist or when palpation and percussion tests are performed. Pulp sensitivity tests are always negative when the aetiological factor is a non-vital pulp. The patient may refer to the tooth as an 'elongated tooth'. Radiographically there is a widening of the periodontal space (Valdrighi & Hizatugu 1974, Maisto 1975, Berbert & Bramante 1976, Marshall 1979, Ingle *et al.* 1985, Blanco & Ritacco 1987, Domingues & Rosa 1989, Cohen 1991, Leal & Lauand 1991, Simon 1991, De Deus 1992, Torabinejad & Walton 1994).

Although many techniques are described for the emergency treatment of the acute apical abscess, another acute manifestation also derived from a non-vital pulp (Egoscue & de Boces 1992, Gutmann 1992, Hasselgren & Caley 1994), few articles deal with the emergency treatment of acute apical periodontitis. Basic management consists of adjustment of the occlusion, elimination of the infected debris from the root canal system by gentle instrumentation coupled with copious irrigation, drying and placement of an intracanal dressing. If the tooth becomes symptom-free within 5 to 7 days, the root canal system is usually obturated (Marshall 1979, Berger 1989, Leal & Lauand 1991, De Deus 1992).

In modern endodontic practice, great emphasis is placed on new root canal preparation techniques performed in a coronal-to-apical direction (Fava 1996) and biocompatible dressings such as calcium-hydroxide pastes and corticosteroid solutions (Orstavik 1988, Ingle & Glick 1994). These dressings are specifically designed to reduce bacteria, control pain and reduce inflammation.

The purpose of this clinical investigation was to compare the incidence of post-operative pain in teeth with acute apical periodontitis derived from non-vital pulps that were dressed with either a calcium-hydroxide paste or a combined corticosteroid-antibiotic solution.

## Materials and methods

For this clinical evaluation, 60 maxillary central incisors from 48 patients of age range 28–64 years were selected consecutively and randomly distributed between the two groups.

The diagnosis of acute apical periodontitis caused by a non-vital pulp was determined by routine diagnostic procedures: chief complaint and history given by the patient, oral examination, lack of response to thermal tests, tenderness to palpation and percussion tests, absence of swelling and the appearance on the pre-operative radiograph. All clinical procedures were undertaken by the author in his private practice and based on the criteria described in previous articles (Fava 1989, 1991, 1995): (i) the patient accepted the two-visit treatment and the criteria for post-operative pain evaluation; (ii) the tooth had a non-vital pulp along with an acutely inflamed periapical region with no swelling; (iii) only maxillary central incisors were selected because they have uncomplicated root morphology; and (iv) the patients were in good general health.

At the first appointment the occlusion of the involved tooth was reviewed. The tooth was anesthetized, isolated with a rubber dam and access gained to the root canal system.

The first stage of the proposed procedure included the removal of the toxic debris from the root canal and chemo-mechanical preparation in a coronal-to-apical direction. Stainless steel triangular cross-sectioned Flexofiles (Maillefer; Ballaigues, Switzerland) with non-cutting tips for hand use were employed with the balanced force technique (Roane *et al.* 1985) using sequentially smaller instruments aided by the use of Gates Glidden burs (Swindle *et al.* 1991, Saunders & Saunders 1992). A 0.5% sodium hypochlorite solution transferred to sterilized anaesthetic cartridges and delivered by a 30-gauge anaesthetic needle was used for copious irrigation after the use of each instrument and burs. This procedure was performed until the apical third was reached, which was evaluated from the initial radiograph.

With the canal free of debris, the second stage of preparation consisted of working length determination and achievement of foramen patency. This patency was carried out with small instruments (size 08 to 10) as proposed by Buchanan (1989).

The third stage was characterized by the development of the apical stop and a step-back procedure to achieve a final conical shape (Mullaney 1979). After the use of each smaller-to-greater instruments and irrigation, the master

apical file (size 35 to 50 depending on the final diameter of the root canal) and patency file were used to maintain the patency of the apical third and foramen during all preparation procedures.

After a final irrigation and drying, all root canals were dressed; one half (group 1) received a calcium-hydroxide paste (Calen; S. S. White, São Paulo, SP, Brazil) and the other half (group 2) received a corticosteroid-antibiotic solution (Otosporin; Wellcome S. A., São Paulo, SP, Brazil). Excess material was removed from the pulp chamber and a sterile cotton pellet was placed over the orifice of the root canal. All teeth were temporarily sealed with Cavit (ESPE, Seefeld, Germany).

The calcium hydroxide paste used in this study was composed of calcium hydroxide (2.5 g), zinc oxide (0.5 g), staybelite resin (0.05 g) and polyethyleneglycol 400 (1.75 ml); it was placed in the root canal using a Lentulo spiral (Maillefer, Ballaigues, Switzerland). The corticosteroid-antibiotic solution was composed of polymyxin B sulphate (10000 IU), neomycin sulphate (5 mg) and hydrocortisone (10 mg) in an aqueous vehicle. This solution was also transferred to sterilized anaesthetic cartridges and delivered into the root canal with a carpule syringe and a 30-gauge anaesthetic needle.

The criteria chosen for post-operative pain evaluation were arbitrary and have been described previously (Fava 1989, 1991, 1995). All patients were contacted 48 h after treatment and asked to report all post-operative reactions. If the patient did not require an analgesic and reported mild or minimal discomfort that disappeared within 48 h, this was classified as none to slight post-operative pain. If the patient reported tolerable discomfort with slight tenderness on biting or palpation of the periapical area that required an analgesic such as aspirin, it was classified as moderate post-operative pain. If the patient reported continuous pain with extreme sensitivity on biting or palpation that required a strong analgesic, the post-operative pain was classified as severe.

Seven days later a further post-operative evaluation using palpation and percussion tests was performed to assess the absence of periapical inflammation. If the tooth was symptomatic, the root canal system was reopened, irrigated with 0.5% sodium hypochlorite solution, dried and redressed. If asymptomatic the system was irrigated, dried and filled by cold lateral condensation of gutta-percha with a calcium-hydroxide-based root canal sealer (Sealapex; Sybron/Kerr, Romulus, MI, USA). At the same appointment, all patients were asked to report any other reactions they experienced between the second and the seventh day.

**Table 1** Incidence of postoperative pain within 48 h

Treatment	None to slight	Moderate	Severe	Total
Group 1	28	2	0	30
Group 2	29	1	0	30
Total	57	3	0	60

**Table 2** Incidence of pain 1 week after the first visit

Treatment	Pain	No pain	Total
Group 1	0	30	30
Group 2	0	30	30
Total	0	60	60

## Results

The results of this clinical evaluation showed no difference in pain incidence between the two groups. In the first evaluation (48 h) only three patients, two in group 1 and one in group 2, reported moderate pain which required the use of analgesics. All the others reported none to slight postoperative pain (Table 1).

The clinical evaluation performed 7 days later also showed no difference between the two groups. The patients who had felt moderate pain at the first evaluation reported no pain at the second evaluation (Table 2).

Patients who described slight post-operative discomfort in the initial 48 h reported that it disappeared within the third or fourth day of the first visit. Based on these results, the root canals of all teeth were obturated at the second appointment.

## Discussion

The results of this clinical investigation showed no difference in the incidence of post-operative pain in non-vital maxillary central incisors associated with acute apical periodontitis when dressed with either a calcium-hydroxide paste or a corticosteroid-antibiotic solution.

Many factors might be associated with these results. The first one to be considered is the extrusion of material beyond the foramen that may enhance pain or result in a flare-up. Some authors (Vande Visse & Brilliant 1975, Hession 1977) demonstrated this extrusion when the endodontic instrument is used in a filing motion acting like a piston in a cylinder. Hession (1977) postulated that early flaring of canal walls would decrease the potential for positive hydrostatic pressure being directed apically by establishing an adequate escape. All coronal-to-apical enlargement techniques support this procedure to avoid the passage of material into the periapical tissues. Although this is a common problem with all instrumenta-

tion techniques, some *in vitro* studies showed less passage of debris when these modern procedures are used for root canal debridement (Fairbourn *et al.* 1987, Ruiz-Hubard *et al.* 1987, Saunders & Saunders 1992).

The *modus operandi* of this technique allows a deeper penetration of the irrigant needle as the preparation moves in an apical direction. This permits the irrigant solution to go further into the root canal reaching the middle and apical thirds sooner than the instrument because of its low surface tension. As a consequence, the neutralization of the toxic debris localized in the apical third is improved and, if some extrusion occurs, there is less chance for a flare-up. The overall cleanliness of the root canal system is also improved; as the preparation advances in apical direction allowing the irrigation needle to go closer to the apex, the removal of necrotic root canal contents is enhanced (Brown & Doran 1975, Abou-Rass & Piccinino 1982, Sinanan *et al.* 1983).

The balanced force technique (Roane *et al.* 1985) was chosen because many *in vitro* studies claimed good results in the maintenance of original canal shape (Powell *et al.* 1986, Southard *et al.* 1987, Sabala *et al.* 1988), lack of apical transportation (Sepic *et al.* 1989, Swindle *et al.* 1991) and centering ability of the instrument (Briseño & Sonnabend 1991, Leseberg & Montgomery 1991). Although no specific studies were performed to evaluate debris extrusion in this technique, Saunders & Saunders (1992) rated their results as excellent for minimal apical debris extrusion.

The patency concept was introduced by Buchanan (1989) and prevents blockage in the apical third of the root canal as well as the foramen. According to the author, 'the use of a patency file consistently throughout cleaning and shaping procedures is the most predictable method to prevent apical blockage as well as to gain more tactile feedback about the apical foramen. A patency file is defined as a small flexible K-file which will passively move through the apical constriction without widening it.' The basic reasons for the use of patency files are: (i) they maintain an unblocked apical third of the canal; (ii) they facilitate debris removal in conjunction with enhanced irrigation; (iii) as the irrigation solution goes further into the root canal, it helps in killing bacteria in the apical third; (iv) as the apical third and foramen are maintained unblocked, the drainage of the inflammatory exudate is more easily achieved, decompressing the tissues and allowing for the entry of oxygen, which is lethal for anaerobic flora; and (v) it favours the placement of the dressing in direct contact with the living periapical tissues.

Intracanal medicaments have been advocated as inter-appointment dressings for many reasons. Messing & Stock

(1988) and Chong & Pitt Ford (1992) state that, in infected root canals, they are used to: (i) eliminate any remaining bacteria after root canal preparation; (ii) reduce inflammation of periapical tissues; (iii) render canal contents inert and neutralize tissue debris; (iv) act as a barrier against leakage from temporary filling; and (v) help to dry persistently wet canals.

Walton & Torabinejad (1989) suggested that intracanal microorganisms may be reduced to a minimum or even eliminated from the root canal by a correct and adequate instrumentation technique coupled with abundant irrigation. If a dressing should be used, they emphasize the use of a calcium-hydroxide paste or steroids as the drugs of choice. Orstavik (1988) prefers calcium hydroxide as an inter-appointment dressing.

Schroeder (1979) stated that the inflammatory tissue response which occurs in acute apical periodontitis is biologically similar to that which occurs in acute pulpitis. Thus, a corticosteroid dressing will control post-treatment pain and prevent the spread of inflammation. Ingle & Glick (1994) recommend a combination of hydrocortisone with neomycin (Neo Cortef 1.5% – Eye Ear drops, sterile suspension – Upjohn Co., USA). The solution employed in this study showed good results when used as an inter-appointment dressing, as it has in vital cases both in humans (Fava 1992) and dogs (Holland *et al.* 1980). Berger (1989) was the first to indicate its clinical use in cases of acute apical periodontitis.

Calcium hydroxide has been widely used in endodontics because of properties such as high alkalinity (Tronstad *et al.* 1981), anti-bacterial activity (Orstavik *et al.* 1991, Sjogren *et al.* 1991; Stuart *et al.* 1991) and the ability to create an appropriate environment that favours hard tissue deposition and apical repair (Cvek 1972, Ghose *et al.* 1987). The calcium-hydroxide paste used in this study also showed good results as an inter-appointment dressing for vital cases (Fava 1992). With regard to the anti-inflammatory action of the paste, it has not been demonstrated scientifically (Allard *et al.* 1987), however, Souza *et al.* (1989) speculated that its action was due to three different mechanisms: (i) hygroscopic action, directly related to the absorption of the inflammatory exudate by the calcium hydroxide *per se*; (ii) formation of calcium proteinate bridges resulting from the combination of  $\text{Ca}^{2+}$  ions with proteins in the vicinity of the intercellular substance of endothelial cells. This combination prevents the exit of exudate from the blood vessels to the tissue; and (iii) phospholipase inhibition which decreases cellular lysis and consequently the liberation of prostaglandins, one of the mediators of inflammation.

The various properties of these medicaments may corroborate the favourable clinical results found in this study when employed as root canal dressings in cases of acute apical periodontitis. However, it must be stressed that these drugs will only exert their functions after through cleaning and shaping procedures using a gentle instrumentation technique which will cause no additional damage to periapical tissues.

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